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Scallop Stock update for Grand Manan and Southwest New Brunswick, SPA 6 - 1999

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Abstract

An area based management plan was implemented in 1997 for the scallop fishery in the Bay of Fundy. Scallop Production Area (SPA) 6 refers to the waters surrounding Grand Manan Island, Campobello and Deer Islands and vicinity. SPA 6 was subdivided into SPA 6A for the area outside the inside zones, SPA 6B for the Grand Manan Island inside zone and SPA 6C for the mainland New Brunswick inside zone. This area was fished by the Mid Bay scallop fleet under a competitive quota system and Full Bay scallop fleet under an Individual Transferable Quota (ITQ) system.

The landings in 1999 from SPA 6 decreased from 1998. Numbers of Mid Bay vessels fishing SPA 6 decreased while there was a slight increase in the number of Full Bay vessels fishing SPA 6 from 1998. Catch rates increased in SPA 6A but decreased in SPA 6B for both fleets. Meat weight sampling indicated a minimal increase in mean meat weight through the year in SPA 6A, was constant in SPA 6B and SPA 6C. Survey indices indicated an increase in average number of commercial sized scallops per tow in the Grand Manan Island inside zone, SPA 6B and minimal decrease in SPA 6A. There was an increase in pre-recruits concentrated in the Duck Island Sound area of SPA 6B. These pre-recruits should be protected from incidental fishing mortality. Survey mean weights per standard tow increased slightly for both areas. Survey catch rates per standard tow were average.

Résumé

Un plan de gestion fondé sur la zone a été appliqué en 1997 à la pêche du pétoncle de la baie de Fundy. La zone de production de pétoncle (ZPP) 6 englobe les eaux entourant les îles Grand Manan, Campobello et Deer et la région avoisinante. La ZPP 6 a été divisée en la ZPP 6A, pour les eaux non comprises dans les aires intérieures, la ZPP 6B pour les eaux de l'île Grand Manan de l'aire intérieure et la ZPP 6C pour les eaux de la côte du Nouveau-Brunswick de l'aire intérieure. Cette région a été exploitée par la flottille Mid Bay, gérée par régime de quotas en concurrence, et la flottille Full Bay gérée par régime de quotas individuels transférables (QIT).

Les débarquements de 1999 en provenance de la ZPP 6 ont été inférieurs à ceux de 1998. Par rapport à 1998, le nombre de bateaux Mid Bay qui ont pêché dans la ZPP 6 a diminué tandis que celui des bateaux Full Bay a légèrement augmenté. Les taux de capture ont augmenté en 6A mais diminué en 6B, cela pour les deux flottilles. Un échantillonnage pour le poids des chairs a montré une très légère augmentation du poids moyen au cours de l'année en 6A et le maintien d'une valeur constante en 6B et 6C. Les indices des relevés ont indiqué une augmentation du nombre moyen de pétoncles de taille commerciale par trait dans la zone intérieure de l'île Grand Manan et la ZPP 6B mais une très légère diminution dans la ZPP 6A. Il y a eu augmentation des pré-recrues concentrées dans la région du détroit de l'île Duck, dans la ZPP 6B. Ces pré-recrues devraient être protégées de la mortalité par pêche accidentelle. Les poids moyens déterminés par trait de relevé normalisé ont légèrement augmenté dans les deux zones. Les taux de capture par trait de relevé normalisé se situaient dans la moyenne.

Introduction

An area based management plan was implemented in 1997 for the Bay of Fundy. Using the biology of the scallop and distribution of the scallop beds, the bay was divided into 7 management areas referred to as Scallop Production Areas (SPA) (Figure 1). SPA 6 refers to Grand Manan and surrounding area. SPA 6 was further divided into SPA 6A for the area outside zone and SPA 6B for the Grand Manan Island inside zone. The boundaries of the new SPA 6B inside zone differ from pre 1997 Grand Manan Island inside zone. The mainland New Brunswick inside zone (SPA 6C) was included in SPA 6A when the SPA boundaries were determined. Fishing was limited in the inside zones from the second Tuesday in January to March 31. SPA 6A was open January 1 to December 31. Meat count, minimum shell height, minimum meat weight and seasonal closures were used for management of the production areas for both fleets. In addition the Full Bay Fleet was managed by Individual Transferable Quota (ITQ) while the Mid Bay fleet have maintained a competitive quota fishery. The Mid Bay fleet was comprised mainly of vessels <14.5 m length overall (LOA) and carry multiple species licenses. The Full Bay fleet consisted mainly of vessels > 14.5 m LOA or 25.5 GT (gross tons) and this license permitted fishing anywhere in the Bay of Fundy (Butler, 1999).

Fishery data consisting of landings, license information and preliminary catch rates, port samples from a Mid Bay Fleet industry sponsored port sampling program and survey information was used to assess the stock status.

Methods

Fishery Data

All vessels >25.5 GT or 14.5 m, licensed to fish scallops in the Bay of Fundy, were required to complete daily logbooks. Since 1996 the number of vessels from either Mid Bay or Full Bay fleets completing logbooks has increased. A Dockside Monitoring Program was initiated in 1996. This required the completion and submission of a Dockside Monitoring Document (DMD) giving information such as date, location, depth, and effort on that fishing trip and catch landed. A dockside monitored trip required a certified dockside monitor to oversee the weigh out of the catch. The information was electronically entered into a database and the database sent to the Commercial Data Division, DFO. Compliance for Mid Bay fleet included hail in and hail out, and the completion and submission of the monitoring document to the monitoring company within 48 hours of landing. Since 1996 the Full Bay fleet were required to have 100% of the landings monitored at dockside.

Landings complied by Statistical Districts from sales slips and logbooks and since 1997 from the Dockside Monitoring Documents were obtained from Commercial Data Division, DFO. For historical comparison, statistical districts 49 through to 53 most closely approximate the catches for the Mid Bay Fleet from SPA 6 (Table 1). These landings indicate where the scallops were landed but not where the scallops were fished.

Since 1997 landings have been compiled by Scallop Production Area using fishing location on the Dockside Monitoring Documents (Table 2).

The information (date, location, number of tows per day, length of tows, crew, depth, bottom type and catch) on the DMDs was used to calculate catch rates and map fishing locations. Catch rates and fishing locations prior to 1996 were not indicative of the fishery for either the Mid Bay or Full Bay fleets. Class 1 data was used to calculate catch rates. This data was complete log information that included effort, catch and location.

Accurate locations are important to partition catch and effort information to the appropriate SPA and SPA subarea. It was important to have effort values that match the catch for catch rate calculations. Documents submitted should have effort data for each day fished corresponding to the landed catch. These were problems encountered with the log files when attempting to analyze the fishery data. As a result any values presented are preliminary. There was a time delay in receiving current fishery information.

Meat Weight Sampling

Meat weight samples have been collected from the Full Bay fleet for several years, however, there are insufficient numbers of samples from the Grand Manan fishing grounds to be representative of the catch composition of the fishery in that area. The sampling was concentrated primarily on Full Bay vessels landing in ports on the Nova Scotia side of the Bay. This program has been funded by DFO Science.

Meat weight samples were not available from the Mid Bay fleet for the Grand Manan area and the southwest New Brunswick side of the Bay of Fundy prior to 1998. In 1998, the Grand Manan Fisherman's Association and Campobello Fisherman's Association initiated an industry sponsored meat weight sampling program for SPA 6. With the support of the fisherman's associations this program continued during the 1999 scallop fishing season. This provided DFO with catch profile information and with the co-operation of the fishers was used to monitor the percentage of small scallop meats (<11g) in the catch in an effort to conserve the smaller scallops for future increase in yield. A meat weight sample consists of 2-500 g samples of scallops collected from the landed catch of a vessel. The date, boat, depth and location the scallops were fished are recorded. The catch muscle was removed and the scallops from each sample are weighed individually and the weight was recorded on the data sheet. The sample information and the meat weights were entered in a spreadsheet and electronically transferred to DFO Science for analysis. The mean, standard deviation, minimum and maximum meat weight, total weight and a meat count per 500g and percentage of less than 11g meats in the samples were calculated monthly by SPA subarea (Tables 5, 6 and 7).

Research Survey

Annual stock assessment surveys of the traditional Grand Manan area, SPA 6A and SPA 6B, were conducted from 1979 to 1991. The annual stock assessment survey for this area resumed in 1996 and since then surveys have been conducted each year. Surveys from

1996 to 1998 used random stations based on historical fishing information with several additional stations based on current fishing location information. An adaptive allocation method was used for the 1999 survey. Five polygons representing areas where according to logbook data, fishing had been conducted during the last couple of years were defined. Using catches and catch rate information, numbers of stations were assigned to each polygon and then stations were randomly selected within the polygon. This was repeated for the second allocation of stations. The criteria used to determine if the second allocation of stations was conducted was if in a given polygon 20% of the stations had greater than 100 scallops then the second allocation of stations were completed for that polygon. At total of 93 stations were completed of which 20 % had to be reassigned due to gear and bottom topography conflicts. As many as 43% of the stations in some polygons had to be reassigned.

Recent research surveys have been conducted in August/September on the research vessel J.L. Hart using 4-gang Digby style scallop gear. This gear consisted of 4 drags with inside width of 76 cm made of 4 mm steel rings with an inside diameter of 75 mm linked together with rubber washers and attached to an angle iron frame at the mouth and a steel plate or section of wood at the bottom. The drag had 7 rows of rings, 9 across and 3 on the side (Kenchington et all, 1997). As smaller scallops have avoided the drags or escape through the steel rings (Robert and Lundy, 1989), two of the drags were lined with 38mm polypropylene mesh shrimp netting. The abundance estimates of scallops less than 80 mm shell height were based on the lined drags. The abundance estimates of scallops 80 mm or greater shell height were based on the unlined drags. The catches were prorated to 7-gang gear for comparison with previous survey information.

Tows were 8 minutes in duration. The distance towed was determined from the continuous reading of latitude and longitude with dGPS (differential Global Positioning System) receiver via computer or on occasion from the start and end latitude and longitude of the tow. The tows were standardized to a length of 800 m or dragged area of 4256 square meters. For each tow the following information was recorded: shell heights in 5 mm intervals for live and dead scallops (shells with both valves still attached at the hinge) by drag; type of substrate; direction of tow (compass bearing); depth (m); tow location (latitude and longitude), and length of tow. From each tow, individual scallop meats were weighed and the corresponding shells were labeled and retained for further analysis.

Research surveys covering portions of SPA 6C have been conducted annually (July) since 1989. The focus of these surveys has been a long term reproductive recruitment study used for aquaculture research carried out at St Andrew's Biological Station (S. Robinson, pers comm.). While most of the survey information was available until 1998 the format was not compatible with the current survey data. When the remainder The data is acquired and converted it will be analyzed and pending the coverage and results may be included in the assessment of the scallop stocks in SPA 6. The 1999 survey data was not available at this time.

Results

Fishery Data

Landings from Statistical Districts 49 to 53 (SPA 6) comprised less than 25% of the total for the Bay of Fundy. There was a 9% decrease in landings from 1998 (Table 1). There has been minimal change in landings since 1996 after the steep decline from the high level in 1993 (Figure 2).

In 1999, there were approximately 207 Mid Bay scallop licenses issued by the DFO Licensing Unit. Numbers of Mid Bay licenses have remained relatively constant the last several years. The majority of these vessels carried multiple licenses with species dependent seasonal openings and closures. There are 99 Full Bay licenses and several vessels also carried licenses to fish other species. In 1999 approximately 130 Mid Bay vessels and 36 Full Bay vessels fished SPA 6. The numbers of active Mid Bay vessels decreased 15% and an increase of 11% for the Full Bay fleet from 1998.

In 1998 the quota for Full Bay fleet was 50 t with a maximum of 30 t from two inside zones, the Grand Manan Island (SPA 6B) and mainland New Brunswick (SPA 6C) inside zones. However landing statistics were compiled as in previous years so the landings for SPA 6C were included with those from SPA 6A. The meat count was reduced to 40/500g and the minimum shell height was 100 mm. Preliminary Full Bay fleet landings for SPA 6 were 21 t, an overall decrease of 43% from 1998. The breakdown by subarea was 13 t landed from SPA 6A, a decrease of 31.5% and 8 t from SPA 6B, a decrease of 56% from 1998 (Table 2).

The final quota for the Mid Bay fleet in 1999 was 110 t with a maximum of 80 t from two inside zones, the Grand Manan Island (SPA 6B) and mainland New Brunswick (SPA 6C) inside zones. As previously mentioned there were no separate landings for SPA 6C. Meat counts were permitted to remain at 45/500g and minimum shell height was 95 mm provided an industry sponsored meat weight sampling program continued. Preliminary landings for the Mid Bay fleet for SPA 6 were 123 t, a 13% decrease from 1998. The breakdown by subarea was 83 t from SPA 6A, no change from 1998 and 40 t from SPA 6B, a decrease of 33% from 1998 (Table 2). The quota was reached during in early June. Additional fishing of 10 t above the quota was permitted in the outside zone with the use of the industry sponsored port sampling program to monitor the presence of smaller meats. The Mid Bay scallop fleet exceeded their quota by 13 t or 11% in 1999. This could be attributed to delays in the transfer of fishing information from fishers to DFO.

Preliminary catch rates for the inside and outside zones are illustrated in Figure 3. The inside zone catch rates indicated greater differences between years than the outside zone.

Preliminary catch rates for SPA 6 were available from the Full Bay fleet (Table 3). Yearly catch rates from 1990 to 1998 were variable. Catch rates for the Grand Manan Island inside zone (SPA 6B) ranged from 10.0 to 31.8 kg/h. The outside zone (SPA 6A) catch rates ranged from 6.7 to 18.8 kg/h. Catch rates have remained fairly constant since 1996 (Figure 4). It must be noted that logbook compliance was very low in the earlier

years therefore catch rates prior to 1996 may not be representative of the fishery. In 1999 the catch rate for SPA 6A was 9.9 kg/h, an increase of 17% from 1998. The catch rate for SPA 6B was 10.2 kg/h, a decrease of 13% from 1998. In 1999 effort decreased for both areas, 28% for SPA 6A and 45% for SPA 6B.

Preliminary catch rates for SPA 6 were available for the Mid Bay fleet (Table 4). Yearly catch rates prior to 1996 were highly variable and should be interpreted with caution as noted previously. Catch rates have remained constant from 1996 to 1998 possibly due to greater logbook compliance. Catch rates ranged from 4.7 to 11.7 kg/h for SPA 6A or the outside zone. SPA 6B or Grand Manan Island inside zone catch rates ranged from 7.3 to 10.9 kg/h (Figure 5). The 1999 catch rate for SPA 6A was 6.1 kg/h, a minimal increase from 1998. The catch rate for SPA 6B was 7.4 kg/h, a decrease of 15 % from 1998. Generally catch rates from the Mid Bay fleet tended to be lower than those from the Full Bay fleet. This could be due to the smaller vessels that comprise the Mid Bay fleet. Effort decreased in 1999, 40% in SPA 6A and 27% in SPA 6B.

The distribution of catches, effort and CPUE for the Full Bay Fleet by one minute square for 1998 and 1999 are shown in Figures 6 to 8. These figures illustrated the changes in fishing patterns for one fleet from one year to the next.

Meat Weight Sampling

In 1999 meat weight sampling data from the participating fisherman's associations has been presented by SPA subarea. The associations participating in 1999 were Grand Manan Fisherman's Assoc., Campobello Fisherman's Assoc., and for the first 4 weeks of the fishing season, Fundy North Fisherman's Association.

A total of 174 samples consisting of 5,889 meat weights were collected from SPA 6A in 1999 (Table 5). The mean meat weight was higher than that of 1998. Monthly mean meat weights although higher than in 1998 remained constant throughout the year. The monthly 'meat count' per 500g varied with the exception of June when the percentage of meats less than 11g increased in the samples. There were a small number of samples all from the same area. The fishery closed on June 11 when the quota had been reached. It was reopened at the end of July with a proposal from the fishers for increased meat weight sampling and catch limit of 10 t. The area was closed in early September when this catch limit was caught. Figure 9 indicated the catch composition of the samples collected since 1998.

There were 3,946 meat weights from 118 samples collected from SPA 6B (Table 6). During the three months this area was open for fishing, the mean meat weight remained constant. The overall mean meat weight was higher than in 1998. The 'meat count' per 500g ranged from 31 to 33 meats with the overall meat count lower that that of 1998. There was decrease in the percentage of meats less than 11g. The catch composition was illustrated in Figure 10.

There were 48 samples consisting of 1,184 meat weights from SPA 6C (Table 7). This was the first year meat weight samples have been collected from this area. Although there are a small number of samples, the mean meat weight was higher and the meat count was lower than SPA 6A and SPA 6B. Percentage of scallops under 11g was almost 50 % less than the other two areas. Figure 11 indicated catch composition for SPA 6C.

Fishing locations of meat weight samples collected in 1999 are indicated in Figure 12. 340 scallop samples were collected in 1999. Total weight sampled was 192 kg representing 2 % of the landed catch.

Meat weight samples are not available from the Full Bay Fleet fishing in SPA 6.

Research Survey

Station locations for the 1999 research survey were indicated in Figure 10.

The 1999 survey indicated an overall increase of 39% in the mean number of scallops per standard tow from 1998. The mean number of commercial sized scallops increased by 7% from 1998, it was the increase of 83% in prerecruits that raised the mean for 1999. (Table 8). The pre-recruits were concentrated between 25 and 40 mm shell height (Figure 14). As in previous years the higher concentrations of scallops were found in SPA 6B, Grand Manan Island inside zone.

Mean number of scallops per standard tow as calculated for all sizes from the inside zone (SPA 6B) indicated an increase of 51% from 1998. There was an increase of 83% in prerecruits from the 1998 numbers, which exceeded the mean numbers found in the 1996 survey. This was promising but scallops under 40 mm have proven very difficult to track in subsequent years. These pre-recruits were found primarily in Duck Island Sound (Figure 17). 1999 survey indicated an increase of 14% in commercial sized scallops from 1998 (Table 8). The increase in mean numbers of scallops covers all size classes greater than 80 mm (Figure 15).

Mean numbers per standard tow have traditionally been lower in the outside zone (SPA 6A). The numbers calculated for the outside zone from the 1999 survey indicated an overall decrease of 6% from 1998. There was a decrease of 8% in prerecruits from 1998. There was a decrease of 4 % in the scallops >80 mm from 1997 (Table 7). Numbers of scallops 55 to 70 mm shell height (incoming recruitment) as well as commercial sized scallops (>80 mm) were the lowest of the survey series (Figure 16).

Allometric relationships derived from shell height and meat weight regressions were used to calculate mean weight per standard tow. In 1999, 3 scallops per 5 mm shell height were collected and shell heights and meat weights recorded, and the shells were labeled and saved for aging. As in the previous surveys the entire catch was measured. The highest catches were found in the inside zone. A large portion of the outside zone has lower meat yield due in part to the deep water areas where habitat may be marginal for scallops.

Mean weight per standard tow expressed as kilograms of meats was calculated for the survey stations (Table 9). In 1999 the overall mean weight was 1.06 kg/std.tow an increase of 22% from the 1998 survey. There was an increase of 20% for scallops > 80 mm and an increase of 38% for prerecruits (<80 mm) from the 1998 survey. When presented by subarea, the Grand Manan Island inside zone (SPA 6B) had an increase of 38% for prerecruits. Commercial size scallops had a mean weight of 1.13 kg/std. tow an increase of 19% from 1998. The mean weights for the outside area (SPA 6A) indicated a 15% increase in scallops >80mm with a mean weight of 0.70 kg/std.tow. There was a decrease in mean weight of scallops < 80mm.

The survey catch rate (kg/h) for all areas was 7.9 kg/h. The catch rate for the Grand Manan Island inside area, SPA 6B was 8.51 kg/h and outside area, SPA 6A, was 5.3 kg/h. There was no change overall and for the inside zone but a slight decrease in the outside zone from 1998 (Table 10).

Conclusions

While landings from districts 49 to 53 most closely approximate the area of SPA 6 these values correspond closely with the Mid Bay Fleet landings. The catches from most of the Full Bay vessels fishing in SPA 6 are landed in Nova Scotia. Since 1997, landings were available by SPA but prior to that comparisons of actual catches from both fleets in SPA 6 were not possible. The mainland New Brunswick inside zone (SPA 6C) was not included in the breakdown by SPA subarea. A large percentage of the January to March landings from SPA 6A could be attributed to SPA 6C.

The extremely low logbook compliance until 1996 meant that any catch rates calculated prior to 1996 may not adequately represent the fishery. In some cases when there has been logbook compliance there has been very little C1 data which was required to calculate catch rates. Provided DMD regulations remain in place there will be the potential for more information on the fishery available in future years. The quality of the data needs improvement. Locations will need to be verified and the catch and effort data on a document should correspond for CPUE calculations to be accurate.

The Mid Bay license numbers remain constant at approximately 207. Active vessels decreased to 130 in 1999. There was an increase in Full Bay vessels fishing SPA 6 in 1999. This fleet has not fished its quota limit in the last three years. As the Full Bay fleet was on an ITQ system and if there is a stock decline in other areas, there may be increased pressure for those vessels to fish the assigned quota from SPA 6.

The industry sponsored meat weight sampling program continued to provide catch composition data and minimized effort on scallops less than 11 g. The meat weight samples were collected from locations that represented the 1999 fishery. Tolerance limits for presence of scallops less than 11 g in the port sample must be determined.

Survey indices of mean number and mean weight of scallops per standard tow are used to identify trends in the stock. There was a sizable increase in numbers of pre-recruits in the inside zone from 1998. These pre-recruits are found primarily in Duck Island Sound, an area subject to concentrated fishing pressure for a short time period, which can result in high incidental fishing mortality. Mean numbers of commercial sized scallops increased for SPA 6B or the inside zone in 1999. There was minimal decrease overall in mean numbers for the outside zone. The mean weight per tow in each of the zones for commercial sized scallops has increased. There was minimal change in the survey catch rates (kg/h).

Survey, fishery and port sampling information indicate that SPA 6B continues to be more productive than the outside area, SPA 6A, however all areas in SPA 6 should be protected against overfishing. The increased mean numbers of pre-recruits found in Duck Island Sound should be protected from incidental fishing mortality. Although the survey indicated an increase in mean numbers and survey mean weight of scallop > 80 mm in SPA 6B this was not a reason to increase catch limits. Both 1997 and 1998 indices indicated decreases and 1999 values are still below those of 1996. There has been a minimal decrease in the mean numbers and an increase in weight for > 80mm scallops for the outside area. As the mean number per tow did not increase, this implies that the weight increase was mainly due to growth. The numbers recruiting to the fishery next year are low.

The 2000 recommended catch level for SPA 6 is 130 t for both fleets. The Full Bay fleet TAC would be 50 t with a maximum of 30 t from both inside zones. The Mid Bay fleet would be 80 t catch level with a maximum 50 t from the inside zones.

Summary

- Landings in 1998 for SPA 6 were 144 t. Mid Bay fleet landed 83 t in 6A and 40 t in 6B. The Full Bay landed 13 t in 6A and 8 t in 6B. Full Bay Fleet has not reached its quota limit in the last three years.

- There was an increase in the number of Full Bay licenses fishing SPA 6 in 1998. Numbers of Mid Bay licenses fishing SPA 6 decreased.

- There was increase in commercial catch rates in SPA 6A and a decrease in SPA 6B. Effort decreased for both fleets fishing in SPA 6.

- The industry sponsored meat weight sampling program for the Mid Bay fleet provided catch composition information. There were no samples from the Full Bay fleet. Catch composition by month indicated the mean scallop weight increased slightly through the year in SPA 6A, was constant in SPA 6B and SPA 6C. Percentage of scallops less than 11 g found in the samples varied greatly in SPA 6A, decreased in SPA 6B and was minimal in SPA 6C.

- Survey results indicate an increase in mean numbers of prerecruits (<80 mm) and scallops >80 mm in SPA 6B. The high concentrations of pre-recruits found in Duck Island Sound should be protected from incidental fishing mortality. Mean numbers in SPA 6A remained constant. The survey mean weights (kg/std. tow) for both inside (SPA 6B) and outside (SPA 6A) zones and overall for commercial sized scallops increased slightly from 1998. There was minimal change in survey catch rates (kg/h).

- The 2000 recommended catch level was 130 t with a maximum of 80 t from both inside zones provided landings can be partitioned by SPA subarea.

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Table 1 . Historical landings (t of meats) by Statistical Districts 49 to 53 from 1980 to 1999. *1998 and *1999 are preliminary.
Source: Commercial Data Division, Policy and Economics Branch, DFO

	Statistical District					
Year	49	50	51	52	53	Total
1980	0.00	144.7	9.1	9.1	0.2	163.1
1981	1.90	485.3	50.4	11.5	8.6	557.7
1982	2.90	240.1	21.7	22.3	1.8	288.8
1983	14.90	265.9	46.3	4.0	6.3	337.4
1984	12.90	207.0	50.9	2.6	11.9	285.3
1985	5.80	181.6	33.5	4.2	12.4	237.5
1986	23.50	172.9	44.8	0.8	10.9	252.9
1987	36.80	132.3	51.0	2.5	14.2	236.8
1988	20.10	250.8	110.1	3.0	14.0	398.0
1989	47.50	361.8	184.9	2.9	26.5	623.6
1990	53.50	308.8	186.2	1.9	21.3	571.7
1991	39.30	182.9	148.4	2.2	4.3	377.1
1992	38.55	185.5	125.5	4.1	10.2	364.0
1993	96.99	184.7	105.2	5.2	16.6	408.7
1994	86.39	169.3	63.1	6.0	19.5	385.6
1995	66.87	183.7	28.7	6.0	11.1	296.4
1996	37.35	112.3	38.8	4.5	3.4	196.3
1997	15.54	96.0	26.9	8.8	4.9	152.2
1998*	10.48	115.9	31.1	8.1	7.5	173.0
1999*	12.77	94.2	34.1	9.4	8.0	158.4

Table 2. Landings and quotas ('effort cap') for SPA 6A and SPA 6B from the Full and Mid Bay Fleets.

*1999 is preliminary.

Source: Commercial Data Division, Policy and Economics Branch, DFO

		Full Bay Fleet			Mid Bay Fleet			
Year		6A	6B	Total	6A	6B	Total	Total
1997	Catch (t)	21	12	33	60	35	95	128
	Quota (t)	-	50	70	-	80	100	170
1998	Catch (t)	19	18	37	82	60	142	179
	Quota (t)	-	30	50	-	50	80	130
*1999	Catch (t)	13	8	21	83	40	123	144
	Quota (t)	-	30	50	-	80	110	160

Table 3 . Commercial catch rates, CPUE (kg/h), from Full Bay fleet Class 1 (C1) data fishing SPA 6

SPA 6A is the outside area and SPA 6B is the inside conservation zone. All values are preliminary.

Area/ Year	Catch (kg)	Cl Catch (kg)	Cl Effort (h)	CPUE (kg/h)	Std. Dev.	No. Vessels C1
SPA 6A						
1990	0	0	0	0	0	0
1991	0	0	0	0	0	0
1992	172	172	15	11.70	3.83	1
1993	710	150	8	18.07	1.00	1
1994	432	126	10	12.60	1.00	1
1995	5,305	2,144	219	9.80	2.49	5
1996	4,538	2,645	207	12.76	3.07	7
1997	16,876	14,879	2,225	6.69	2.85	31
1998	14,014	13,215	1,564	8.45	4.69	27
1999	11,121	11,121	1,127	9.87	5.35	23
SPA 6B						
1990	0	0	0	0	0	0
1991	975	0	0	0	0	0
1992	0	0	0	0	0	0
1993	4,275	2,021	89	22.66	6.49	6
1994	1,762	1,422	45	31.81	6.26	1
1995	78	0	0	0	0	0
1996	10,518	2,204	202	10.89	5.17	6
1997	10,903	10,284	1,028	10.00	3.89	24
1998	18,038	16,751	1,461	11.47	9.12	26
1999	8,197	8,197	807	10.15	4.80	28

Table 4 . Commercial catch rates, CPUE (kg/h), from Mid Bay fleet Class 1 (C1) data fishing SPA 6

SPA 6A is the outside area and SPA 6B is the inside conservation zone. All values are preliminary.

Area/ Year	Catch (kg)	CI Catch (kg)	CI Effort (h)	CPUE (kg/h)	Std. Dev.	No. Vessels C1
SPA 6A						
1992	0	0	0	0	0	0
1993	150	85	18	4.74	0.43	1
1994	612	513	56	9.12	4.77	2
1995	3,469	2,239	192	11.68	8.40	3
1996	12,893	9,743	1,351	7.21	51.51	24
1997	65,561	60,098	11,177	5.38	4.93	124
1998	78,340	71,474	12,096	5.91	3.09	105
1999	47,857	44,507	7,291	6.10	4.04	94
SPA 6B						
1992	0	0	0	0	0	0
1993	2440	0	0	0	0	0
1994	563	66	7	10.12	1.78	1
1995	679	456	42	10.86	2.12	2
1996	16,557	10,019	1,164	8.61	8.13	17
1997	36,419	34,152	4,673	7.31	4.61	62
1998	58,955	54,036	6,213	8.70	3.68	51
1999	36,864	33,694	4,564	7.38	3.26	51

Table 5. SPA 6A (outside zone) industry sponsored scallop meat weight sampling program statistics.

Year / Month	N	Meat Weight (g) Mean	SD	Min	Max	Meat Count per 500g	Total Weight (g)	% no. <11g meats	Number samples
1998									
May	1190	11.50	3.34	3.7	24.6	43.49	13682	47	24
June	1006	12.69	4.10	4.7	47.7	38.87	12942	35	24
July	731	13.64	6.05	4.8	57.9	36.67	9969	36	18
August	313	10.04	3.11	4.7	24.4	49.79	3143	67	6
Total	3,240	12.21	4.44	3.7	57.9	40.95	39560	43	72
1999									
January	204	16.02	5.55	5.5	34.3	31.21	3269	24	6
February	424	14.54	5.76	4.1	65.1	34.40	6163	24	12
March	420	14.86	3.80	4.1	26.5	33.65	6241	12	12
April	566	15.00	4.69	7.2	60.6	33.33	8492	2	16
May	650	15.94	8.76	5.0	67.2	31.36	10363	15	20
June	224	8.95	2.11	4.9	15.2	55.85	2005	81	4
July	554	16.86	6.47	8.4	69.6	29.65	9342	6	16
August	2,365	16.16	8.39	5.6	76.1	30.94	38222	13	74
September	482	14.76	7.52	8.0	70.1	33.88	7112	14	14
Total	5,889	15.49	7.36	4.1	76.1	32.28	91209	15	174

Table 6. SPA 6B (inside Grand Manan zone) industry sponsored scallop meat weight sampling statistics.

Year / Month	N	Meat Weight (g) Mean	SD	Min	Max	Meat Count per 500g	Total Weight (g)	% no. <11g meats	Number samples
1998									
January	1,117	14.74	5.59	4.3	42.6	33.92	16467	25	28
February	1,033	15.08	5.94	3.6	38.9	33.16	15577	28	32
March	515	15.34	5.90	4.8	35.4	32.60	7898	26	16
Total	2,665	14.99	5.78	3.6	42.6	33.36	39942	26	76
1999									
January	1,305	14.93	6.36	2.1	48.9	33.49	19484	29	38
Februauy	1,942	15.39	6.32	4.1	53.9	32.48	29897	26	58
March	699	16.19	6.77	5.2	55.2	30.89	11314	19	22
Total	3,946	15.38	6.43	2.1	55.2	32.51	60695	26	118

Table 7. SPA C (inside 2 mi NB zone) industry sponsored scallop meat weight sampling program statistics.

Year / Month	N	Meat Weight (g) Mean	SD	Min	Max	Meat Count per 500g	Total Weight (g)	% no. <11g meats	Number samples
1999									
January	893	23.86	14.20	4.5	80.8	20.95	21310	14	32
February	194	22.97	14.94	7.3	69.5	21.76	4457	14	8
March	97	44.51	16.86	14.4	87.1	11.23	4318	0	8
Total	1184	25.409	15.631	4.5	87.1	19.68	30084	13	48

Table 8. Mean number of scallops per standard tow from research surveys.
se = standard error. N = number of stations

Year	Inside				Outside				Combined			
	<80 mm (se)	>80 mm (se)	Total (se)	N	<80 mm (se)	>80 mm (se)	Total (se)	N	<80 mm (se)	>80 mm (se)	Total (se)	N
1996	88.6 (9.9)	142.9 (27.3)	231.6 (34.3)	32	19.3 (7.4)	46.0 (6.0)	65.3 (10.8)	33	67.0 (8.5)	80.2 (21.2)	147.2 (27.1)	65
1997	35.8 (5.7)	102.9 (12.3)	138.8 (16.9)	35	9.6 (2.3)	46.7 (7.4)	56.3 (9.2)	30	23.7 (4.7)	77.0 (10.9)	100.7 (14.7)	65
1998	72.4 (11.5)	64.9 (7.0)	137.3 (16.8)	50	12.5 (3.1)	58.1 (13.1)	70.5 (15.7)	43	44.6 (9.5)	61.8 (10.2)	106.4 (16.8)	93
1999	132.7 (52.7)	74.1 (10.7)	206.8 (56.3)	48	11.5 (2.7)	55.5 (8.4)	67 (9.8)	35	81.4 (40.6)	66.2 (9.8)	147.6 (43.9)	83

Table 9. Survey mean weight (kg meats) of scallops per standard tow from research surveys.
se = standard error. N = number of stations

Year	Inside				Outside				Combined			
	<80 mm (se)	>80 mm (se)	Total (se)	N	<80 mm (se)	>80 mm (se)	Total (se)	N	<80 mm (se)	>80 mm (se)	Total (se)	N
1996	0.42 (0.10)	1.18 (0.13)	1.6 (0.18)	32	0.03 (0.01)	0.65 (0.08)	0.68 (0.09)	33	0.22 (0.07)	0.91 (0.10)	1.13 (0.15)	65
1997	0.12 (0.03)	1.46 (0.16)	1.58 (0.18)	35	0.03 (0.01)	0.63 (0.09)	0.66 (0.10)	30	0.08 (0.02)	1.08 (0.14)	1.15 (0.16)	65
1998	0.13 (0.02)	0.95 (0.10)	1.08 (0.11)	50	0.02 (0.01)	0.61 (0.11)	0.63 (0.12)	43	0.08 (0.02)	0.79 (0.10)	0.87 (0.12)	93
1999	0.18 (0.05)	1.13 (0.15)	1.32 (0.17)	48	0.001 (0.002	0.70 (0.09)	0.71 (0.09)	35	0.11 (0.04)	0.95 (0.13)	1.06 (0.14)	83

Table 10. Survey catch rate (kg/h) from the SPA 6 scallop assessment surveys.

Year	Inside >80 mm	Outside >80 mm	All >80 mm
1996	8.82	4.9	8.47
1997	10.96	4.7	8.64
1998	7.17	7.2	6.5
1999	8.51	5.3	7.96

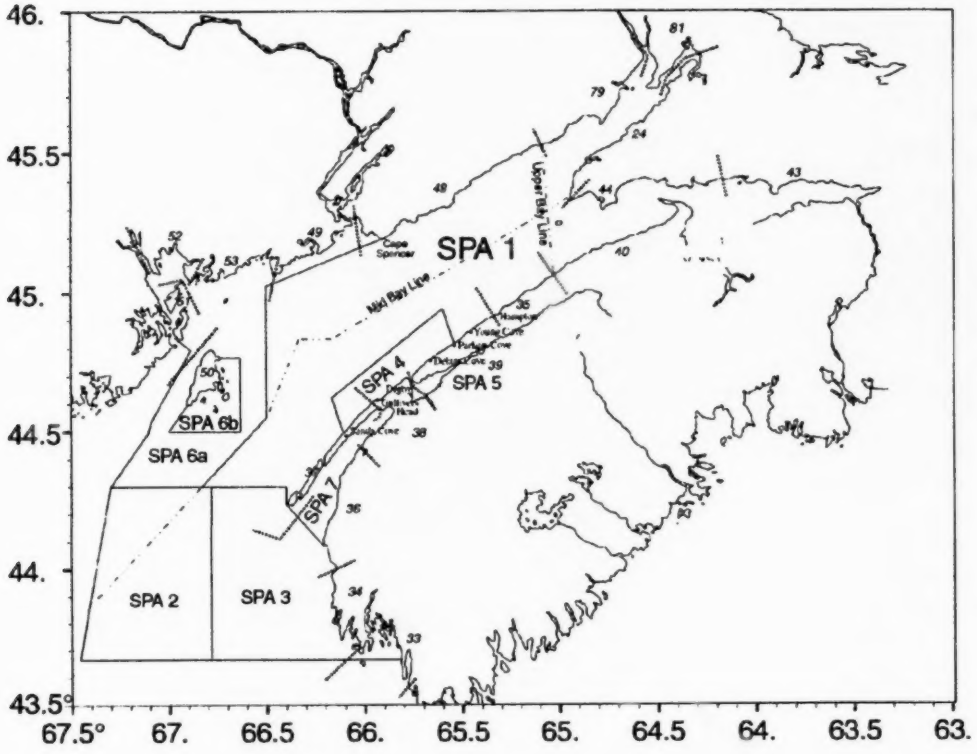

Figure 1. - Scallop Production Areas (SPA's), regulated lines and Statistical Districts in the Bay of Fundy.

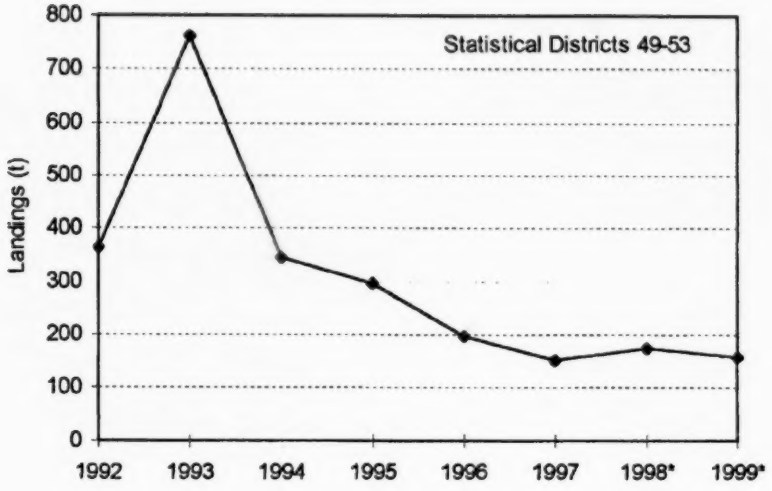

Figure 2. Yearly landings compiled by Statistical Districts 49 to 53. 1998* and 1999* are preliminary.

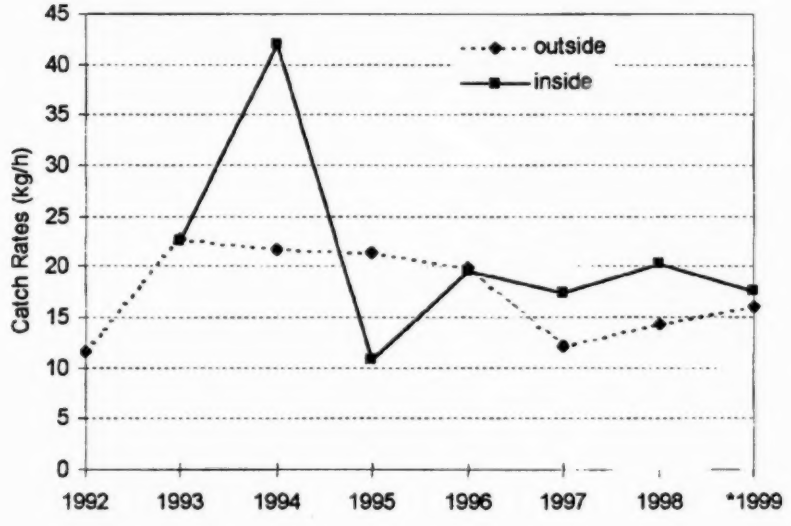

Figure 3. Catch rates (kg/h) for inside and outside zones (SPA 6) from both scallop fleets. *1999 data is preliminary.

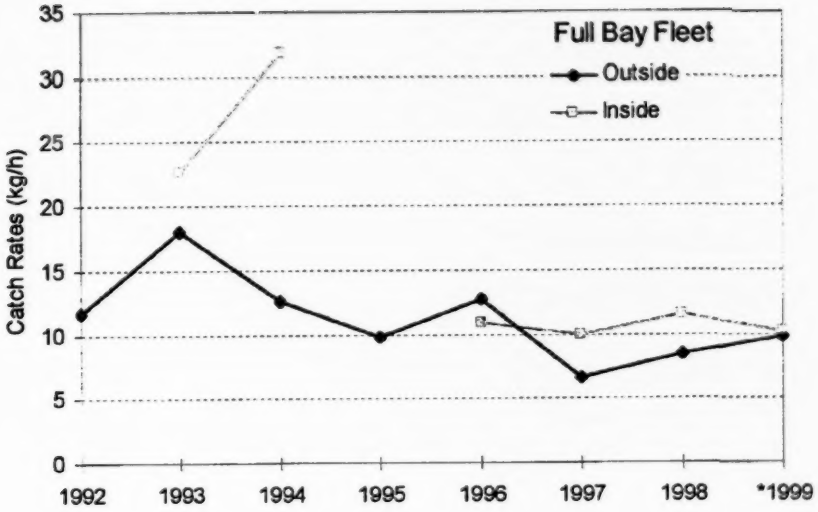

Figure 4. Catch rates (kg/h) for the inside and outside zones from the Full Bay Fleet. 1999 data is preliminary.

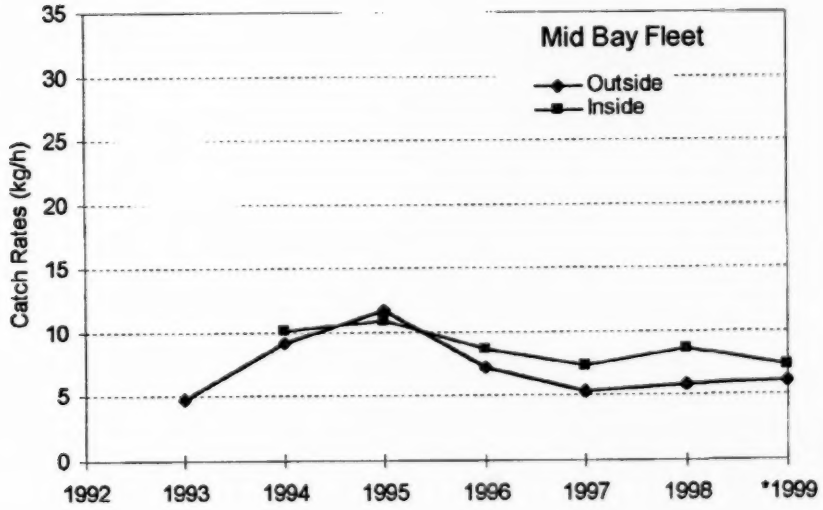

Figure 5. Catch rates (kg/h) for the inside and outside zones from the Mid Bay Fleet. 1999 data is preliminary.

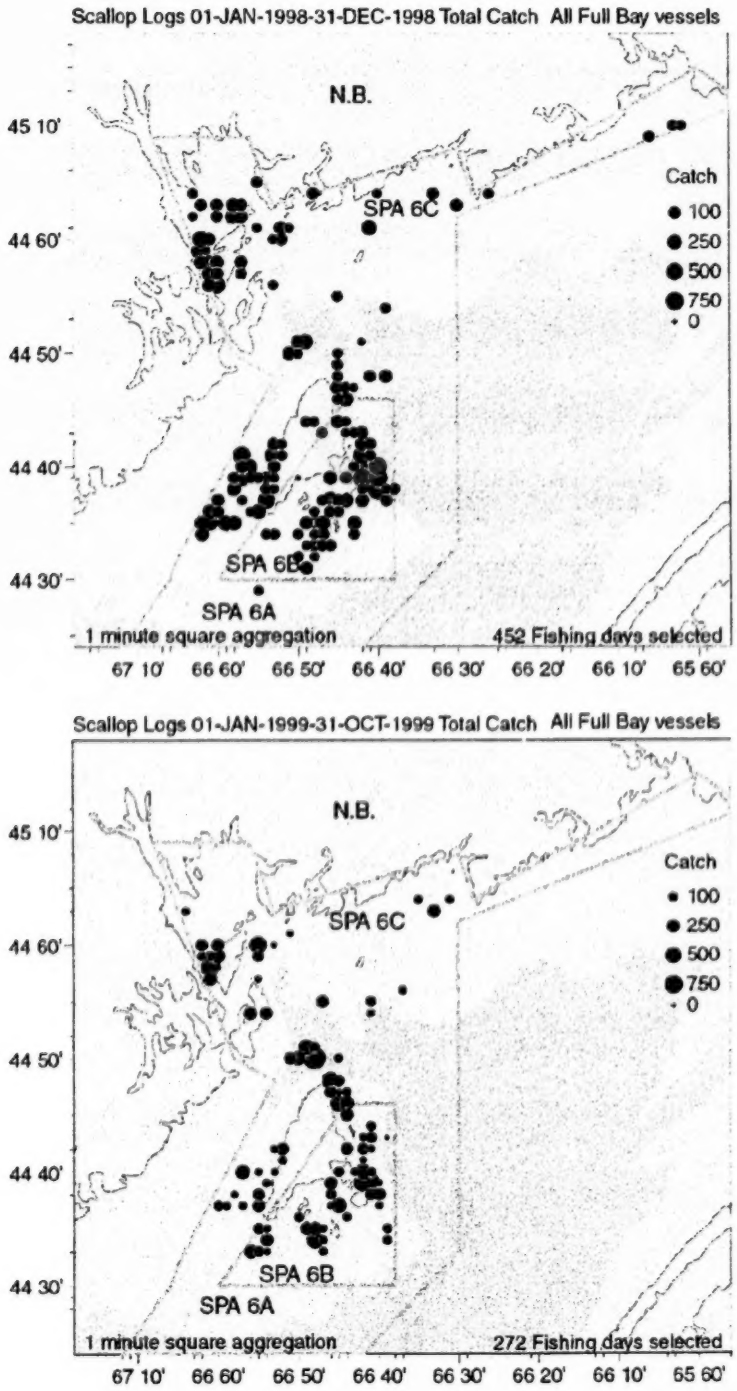

Figure 6 . Full Bay scallop fleet catches (kg) by location for 1998 and 1999.

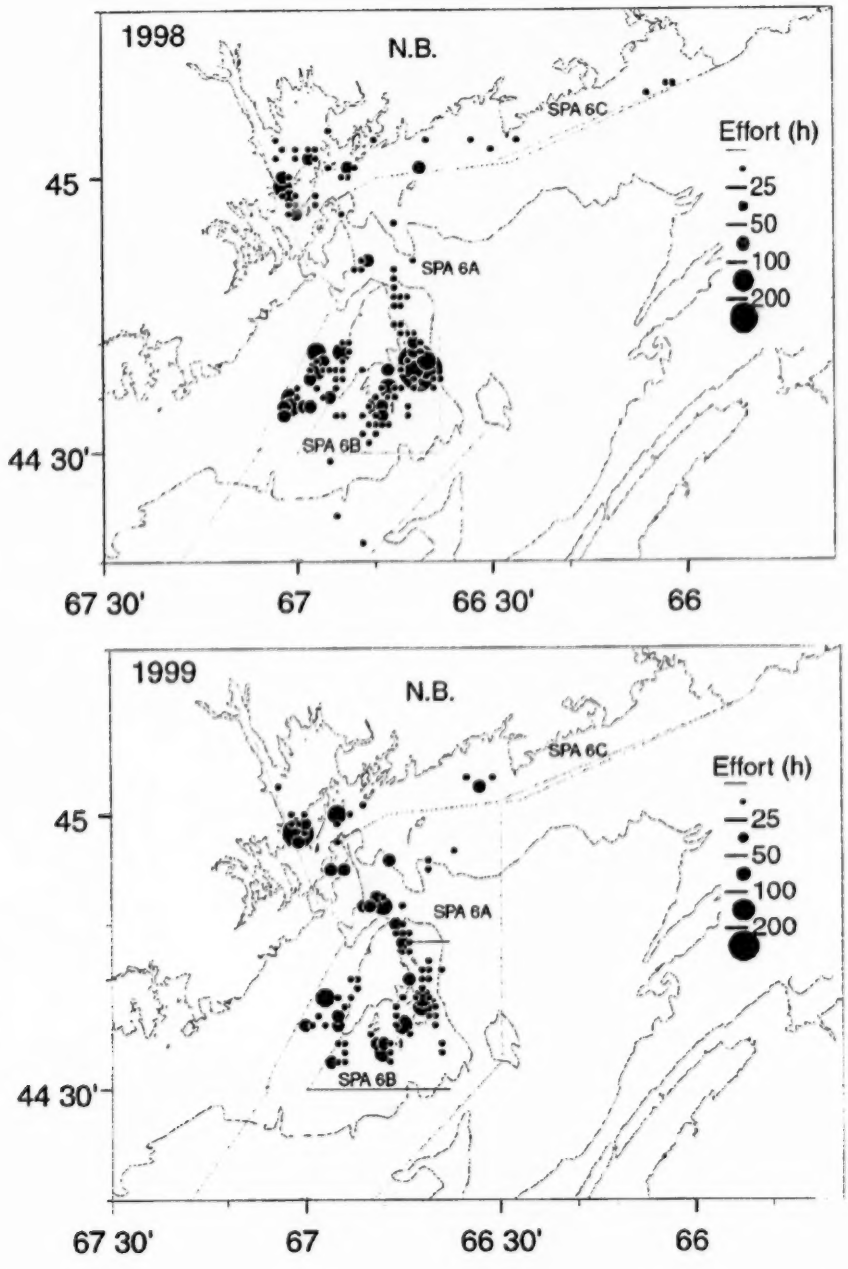

Figure 7. Effort (h) from the Full Bay Fleet by location for 1998 and 1999.

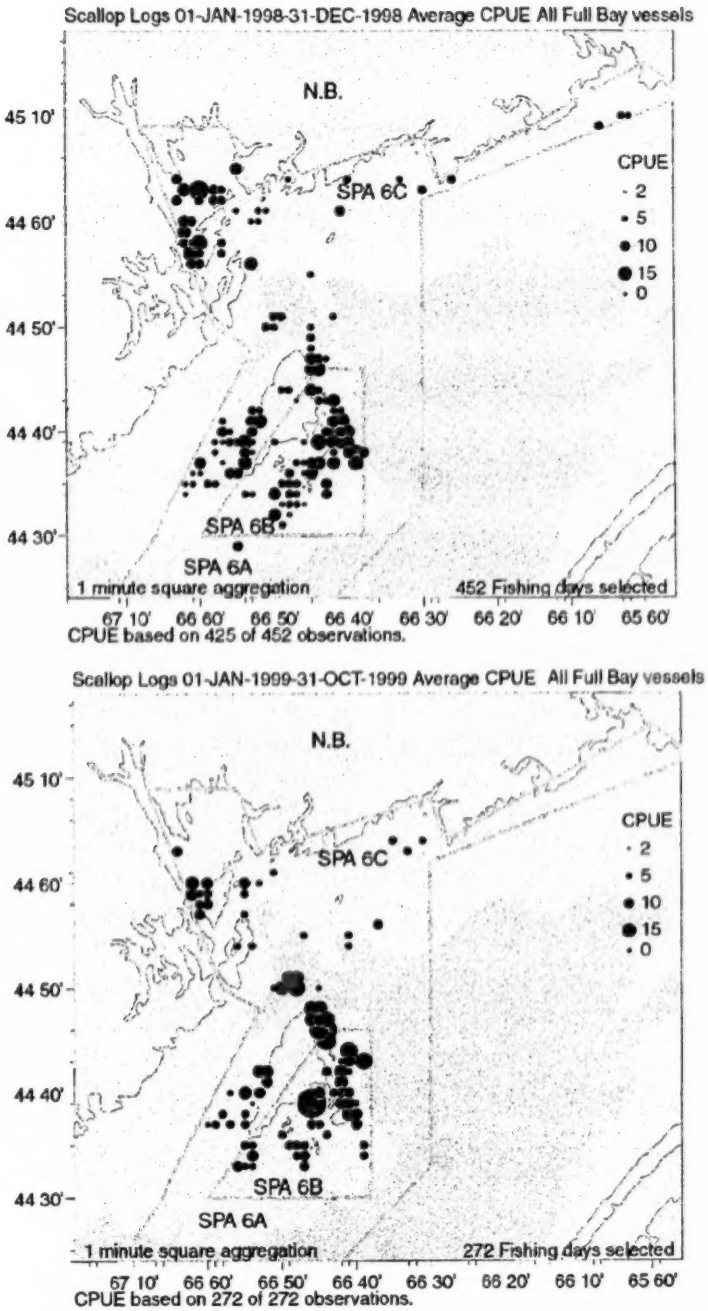

Figure 8 . CPUE (kg/h) by location for the Full Bay scallop fleet in 1998 and 1999.

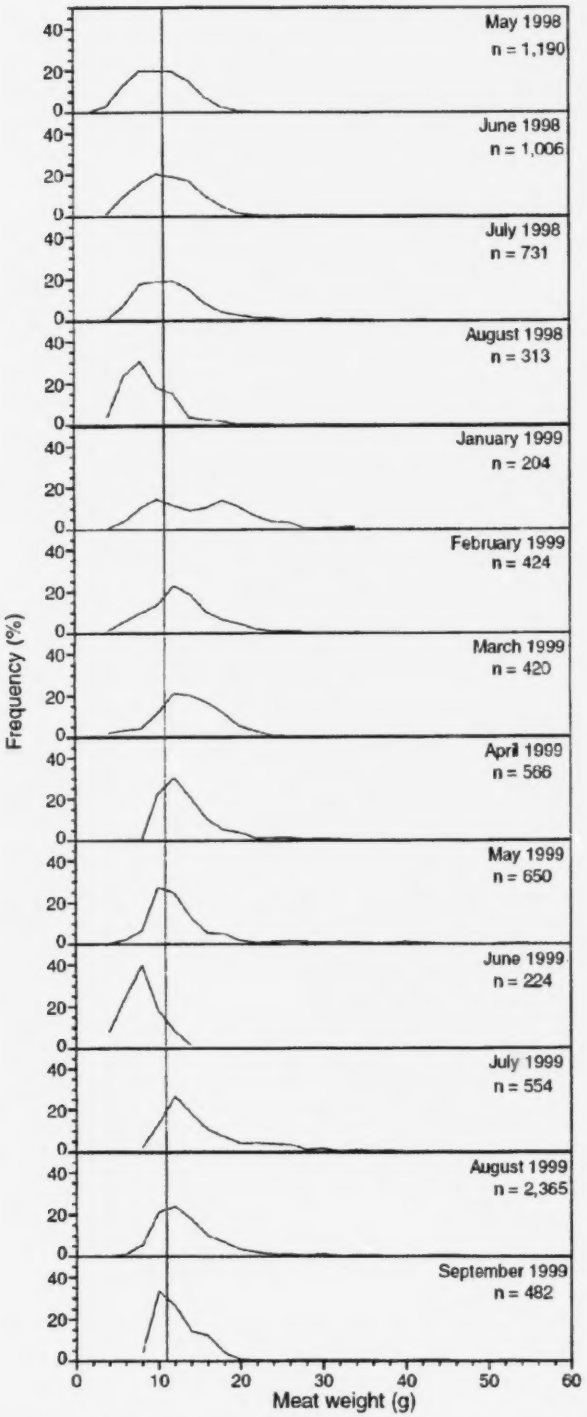

Figure 9. Frequency distribution of meat weights for SPA 6A (outside zone) from industry sponsored port sampling program. A line indicated the 11g meat weight.

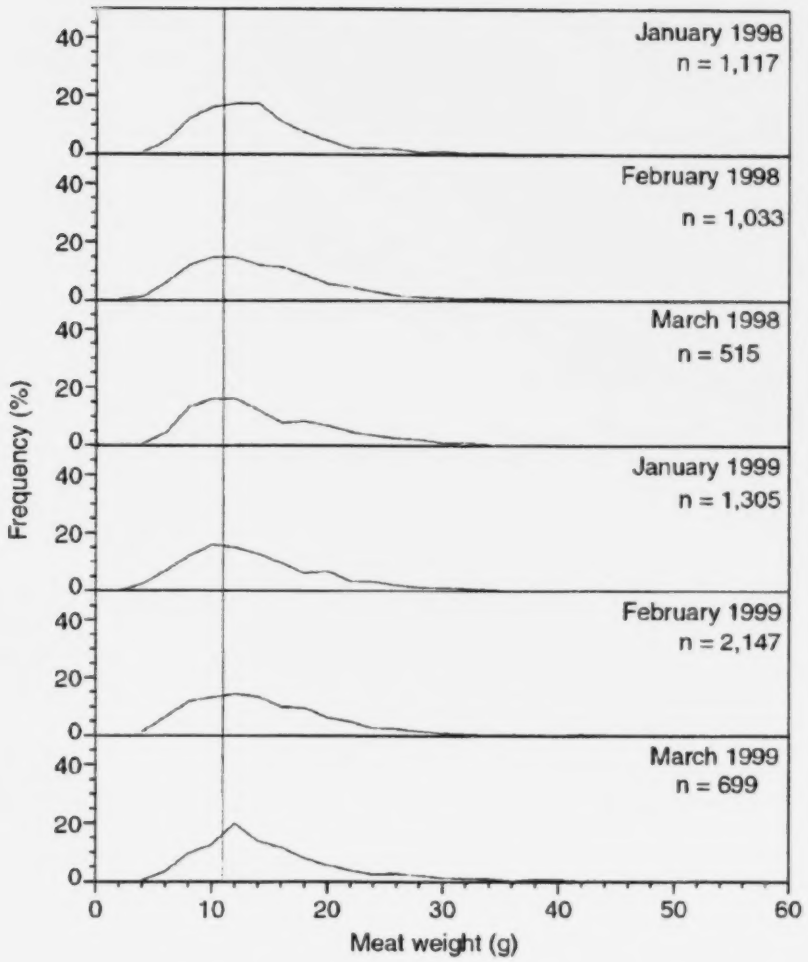

Figure 10. Frequency distribution of meat weights for SPA 6B (inside Grand Manan zone) from industry sponsored port sampling program. A line indicates the 11g meat weight.

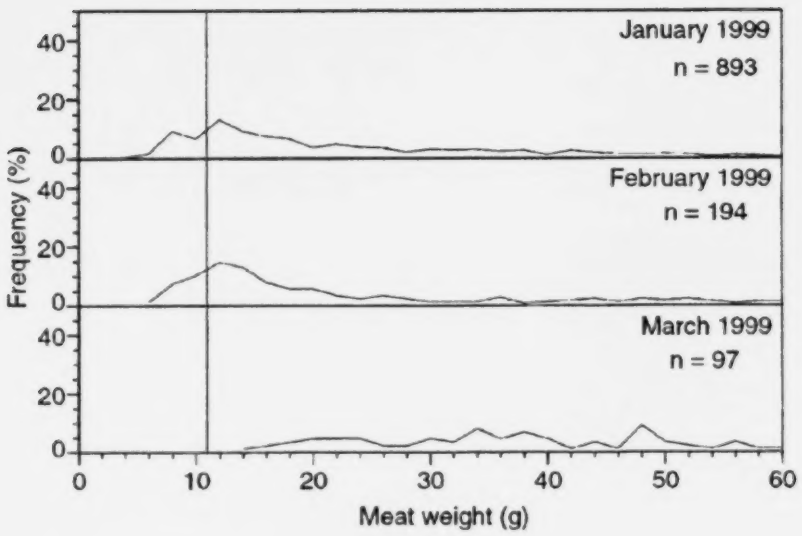

Figure 11. Frequency distribution of meat weights for SPA 6C (mainland NB inside zone) from industry sponsored port sampling program. A line indicates the 11g meat weight.

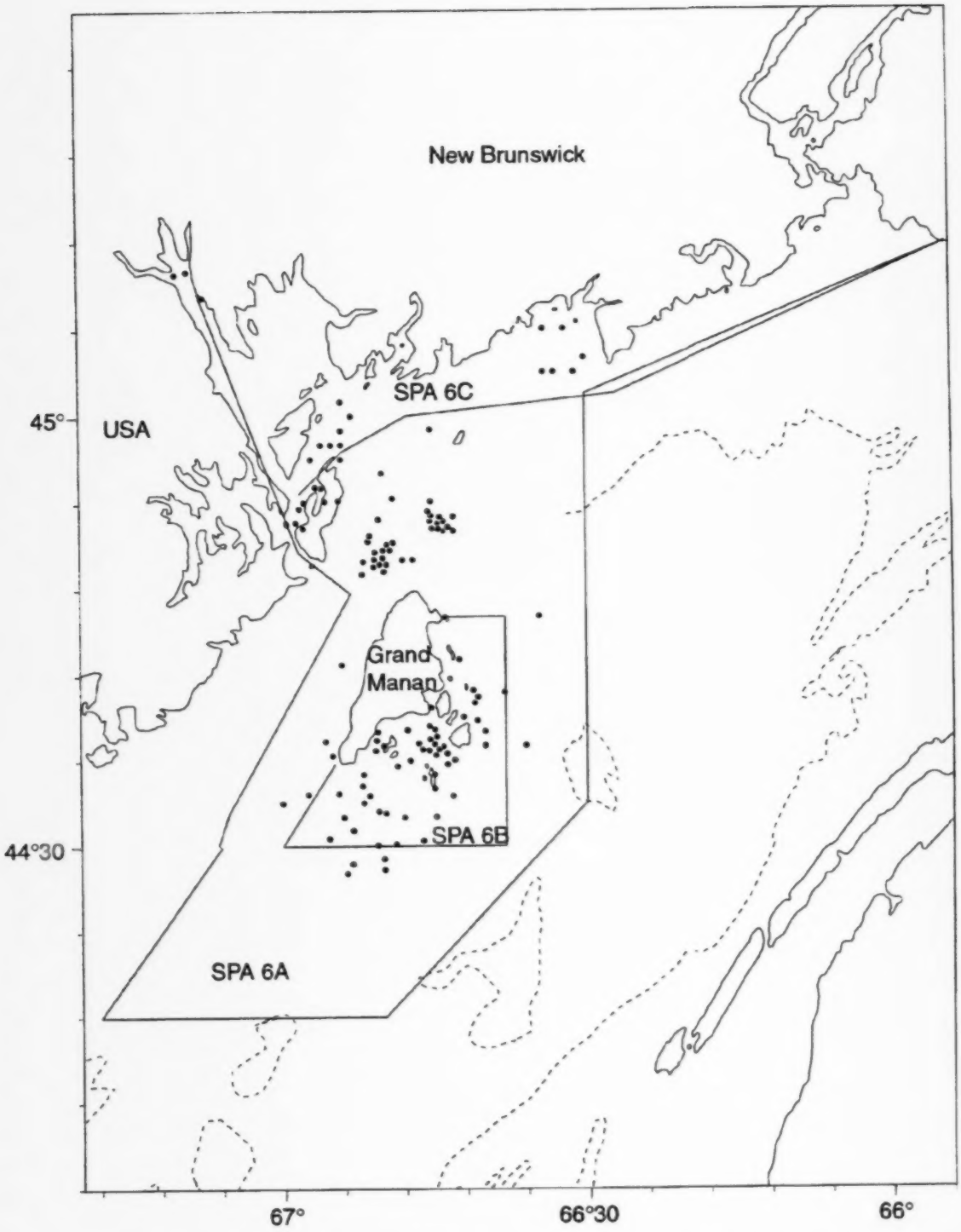

Figure 12 . Locations of meat weight samples from 1999 industry sponsored meat weight sampling program.

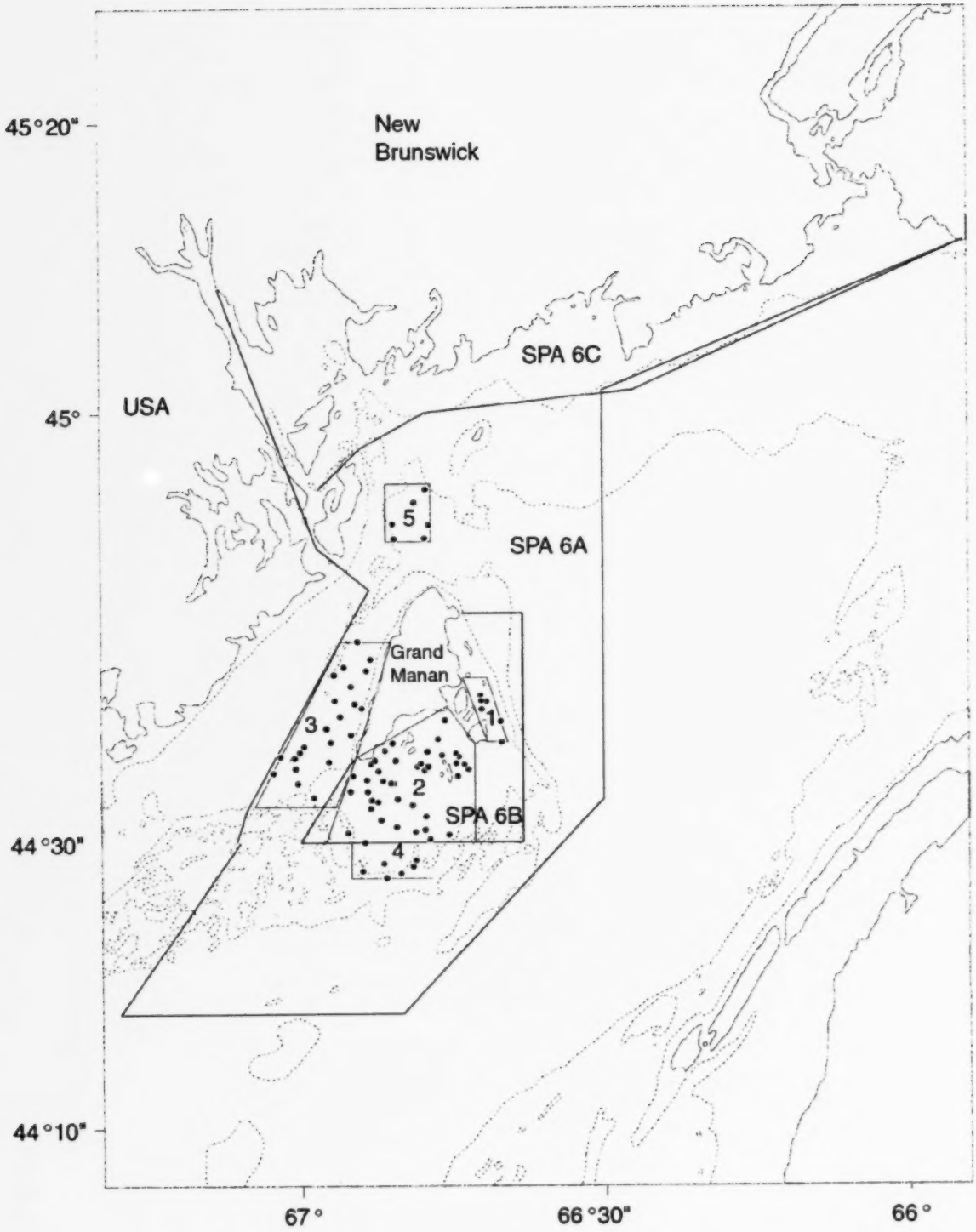

Figure 13. 1999 Grand Manan and area scallop assessment survey station locations.

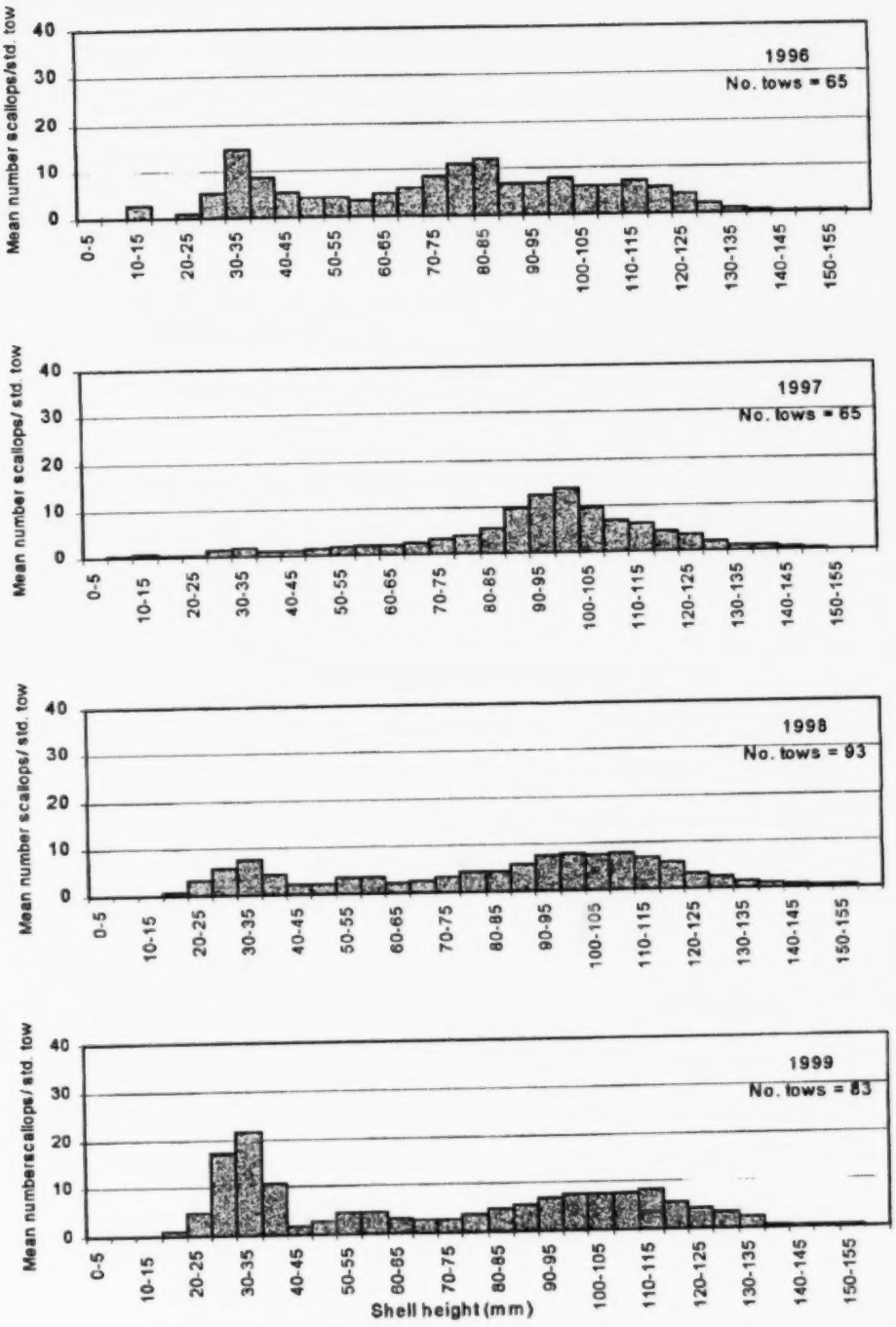

Figure 14. Shell height distribution from annual stock surveys in SPA 6.

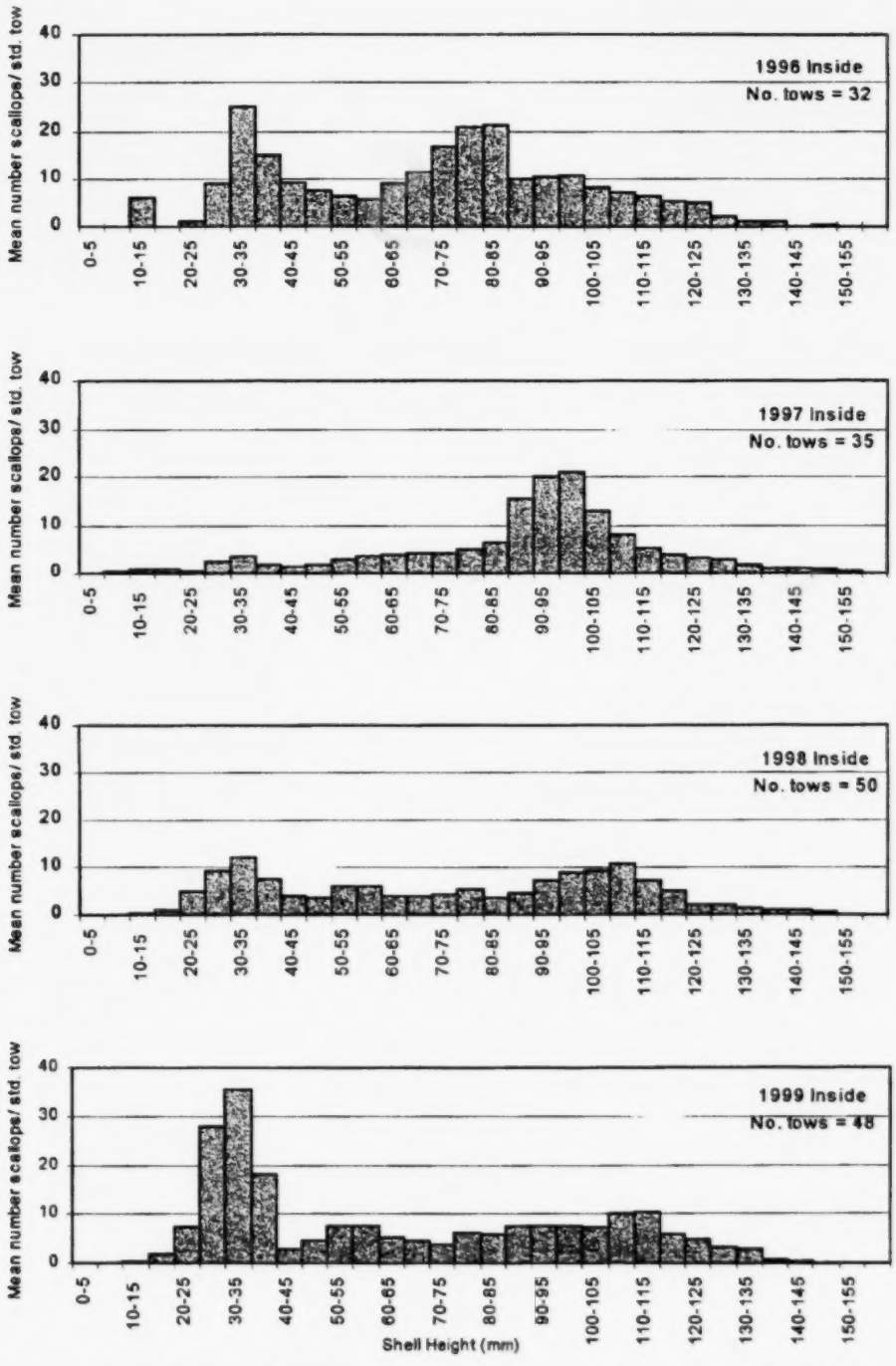

Figure 15. Shell height distribution from annual stock surveys in SPA 6B, the Grand Manan Island inside zone.

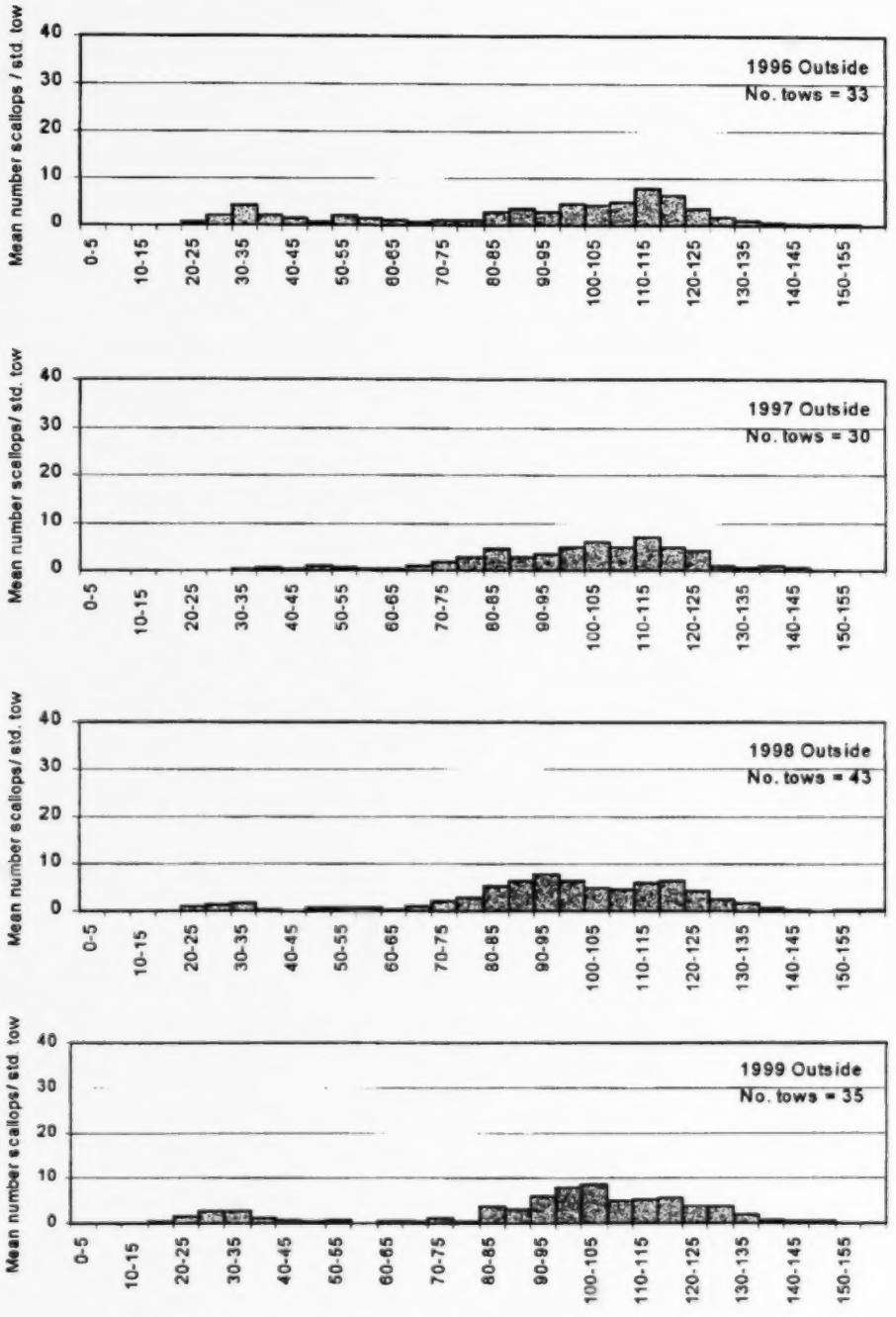

Figure 16. Shell height distribution from annual stock survey in SPA 6A, outside the Grand Manan inside zone.

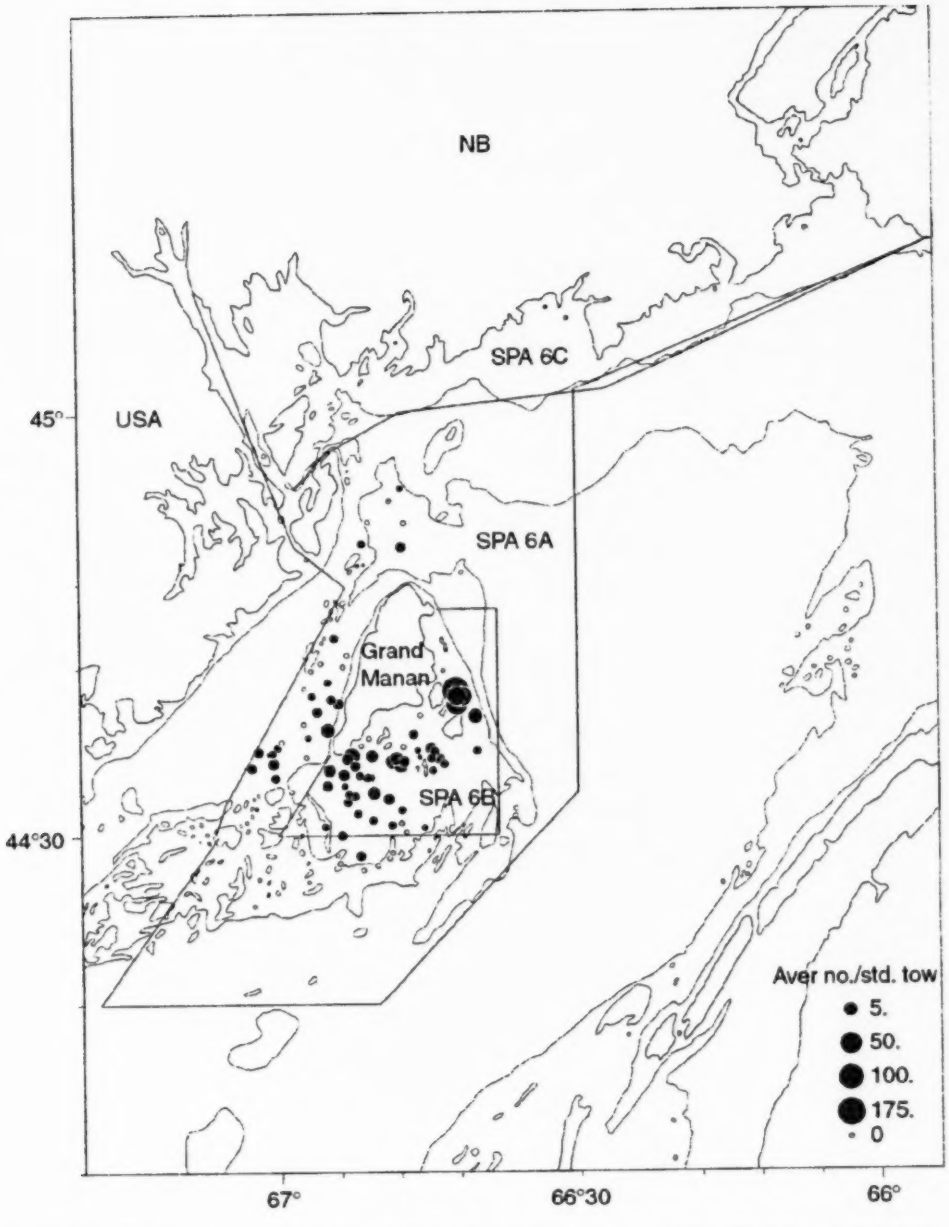

Figure 17. Average number of scallops < 80 mm per standard tow from the 1999 stock survey.